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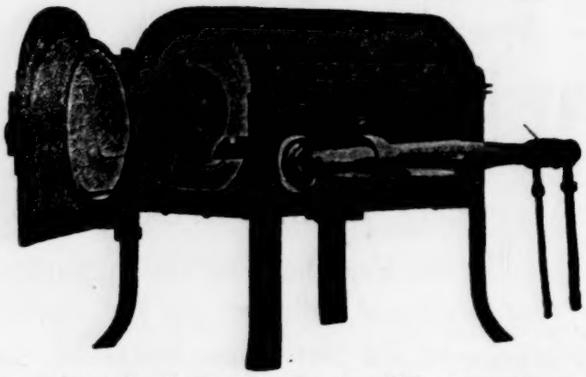

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COMMON AIMS OF CULTURE AND RESEARCH IN THE UNIVERSITY[1]

By definition universities aim to compass the whole range of knowledge. In practical operation they are characterized rather more by diversity than by unity of effort. It is in the nature of things that bodies so constituted should attempt to express the various phases of thought represented through many kinds of organization, and we expect to see philological, chemical, biological and other types of clubs or societies forming a normal part of the machinery of every great educational institution. According to the particular interests of the moment these agencies within the walls group themselves in different ways to accomplish specific kinds of service.

The most interesting of all organizations peculiar to the university are the two widely inclusive societies representing scholarship or culture in Phi Beta Kappa and research and science in Sigma Xi. These two bodies express in their aims nearly the whole range of higher purposes of academic effort. It has seemed to me that a study of their interrelations, extending to a redefinition of their common objects, might help to set forth that continuously needful statement and restatement of the reason for existence of institutions of higher learning. Inclination to consider the purposes of these societies has been particularly strong as the course of my life has carried me into contact with research and education in such a manner as to bring into close relation, and yet into striking contrast, the types of academic mind which we call scientific and humanistic. Having seen these interests so frequently defined with special reference to their separateness the desire has grown

[1] Presented as the annual address before Phi Beta Kappa and Sigma Xi, University of Pennsylvania, June 13, 1921.

to secure a better understanding of their true relations.

Although recognizing fully the specific aims of scientific and of humanistic investigation one can not avoid being impressed with the importance of considering the similarity of their methods and purposes. It is particularly desirable to consider this interrelation as a great group of thinking people still holds humanistic and scientific problems so different that common criteria may not be used generally in their solution.

Scholarship and culture as they are involved in the aims of Phi Beta Kappa have been considered often to represent a goal quite different from that toward which the scientific investigator strives in Sigma Xi. Scholarship should mean understanding and wisdom, not merely information. Culture has been taken to represent refinement of educational attainment and appreciation of knowledge, coupled with the development of personal characteristics giving that balanced judgment sometimes known as mental poise. Culture should furnish perspective and interpretation. Its perspective should make it possible to fit into their proper relations all available facts and to determine the position which new knowledge should take. In its truest expression it should be active and not passive, constructive and not absorptive. The imitative spirit is its greatest danger. True culture is a comprehensive vision and an attitude of the active interpreting mind.

Sigma Xi was organized to promote comradeship in research. Its activity has been limited not infrequently to the so-called natural history subjects. I am unable to conceive of this organization as functioning logically if it does not cover the whole range of investigative or constructive thought in which the scientific method is used. I think of it as standing for development of the attitude of mind which produces the builder, rather than for conduct of specific researches within a limited field.

Research has been defined as a reaching out to bring together, organize and interpret whatever may be added to our store of knowledge. It may express itself in the most intensive studies in very narrowly defined regions, but is most truly exemplified when it involves the wider relationship of specific facts to the whole structure of knowledge.

In the processes of research it is difficult to distinguish between those operations which are merely the gathering and those which are interpretation and definition. Simple collecting of materials without giving them their proper places and without interpreting them is work of a relatively low order and is doubtfully classed as original investigation.

By definition the present discussion is limited to relationships between culture and research as expressed in the university. A clear understanding of my purpose, therefore, involves recognition of the real aim in university activities. Without intending to offer a complete classification of the objects and plans of educational work it may be well to set forth the following as representing some of the aims of university life. These are, first, to hold before young men and women the mirror of knowledge and experience in which they may be able to see reflected the qualifications which fit them individually for this or that profession; second, to give classified information; third, to develop wisdom or judgment; fourth, to stimulate the growth of constructive or creative ability; and, fifth, to inculcate the element of character, which defines our relation to the world of human life. The highest aims of education are far from being generally understood. Many still think of this agency as informational rather than constructive, teaching imitation rather than initiative, and as focussed upon the past rather than the future.

One of the most fully valid criticisms of university study lies in the fact that too often it looks backward without adequate expression of relation between past and future. The young men and women who form the student body are at that early stage in which they have practically no past and naturally live in the present and future. Their eyes are turned forward with keen expectation of what the coming years may bring. Life and movement of life are to them the supreme enjoyment. Until their individual pasts begin to evidence marked effect upon the trend of their futures, uninterpreted history and experience

represent to them only shadowy forms or objects of ill-defined curiosity. Quite in contrast to the ideas of youth the machinery of the university may lend itself to too strong emphasis upon what is behind us. Thus educator and educated seem to look in opposite directions, and like Lot's wife, who "looked back from behind him," the educator may become as lifeless as a stone or fossil without sensing the change, while the company of youth moves on.

With a well-ordered program of university work, development of constructive ideals in the student inevitably carries with it in the scientific studies an unlimited series of questions regarding the relation of each element of nature to other items or forces, and requires recognition of continuity or law through all space and through past, present and future. Similarly in humanistic study the ideals of conduct and character come to rest upon realization of a continuity of interests and responsibilities in the world of human life. These ideas of interrelation, which may in one sense be called law, are necessary to the clear expression of both research and culture. Scientific understanding of nature depends upon our realization of the continuity of its principles of being and action. The meaning of what is covered by culture and scholarship we shall not know adequately until we understand the interrelations of events in the history of human institutions.

Large use of the principle of unity is essential if we would succeed in attaining the ideals of education either in science or in culture. The university programs which have greatest value are not prepared for the immediate future of the student but concern rather his activities at the time of maximum effectiveness. If the student's life be of normal span he graduates near 21 and his period of greatest value to the world lies between 35 and 65, or from ten to forty years after graduation. If the many years of education are to count in the stage of most fruitful service, the work must be carefully planned for attaining this end. It should be clear that the most valuable information which the student carries away is not comprised in the immediately practical things for use to-morrow or the next day, but in the basic principles and methods which in later years will help to answer the new and critical questions certain to arise, and in the answering of which there will be the largest opportunity for personal development. The details of specific studies in university experience are largely lost, but the attitude of mind resulting from honest thought, and the elemental laws which furnish the foundation for all constructive work will be of increasing importance.

From the point of view of culture and also of science the subject of history is one of the greatest of all agents for making possible our understanding of the principle of continuity. History has not too often been considered a science, although in its effect upon the human mind its operation is almost identical with the idea of continuity or unity in physical laws. It has had too small a part among the great opportunities of humanistic education. Oddly enough the tritest phrase growing out of this study is that "history repeats itself," and therefore we seem only to be studying a past which in effect may be repeated in the present or future. But what is it that history repeats? In addition to the idea of continuity, the most evident things coming out of historical research are that history expresses two almost unvarying principles, one, instability, the other, progress; one the view that everything is subject to change; the other that this instability includes in its operation a general movement toward what is more complex and in the realm of intelligence toward fuller comprehension and understanding. I am willing that this statement be challenged, and shall not attempt within these narrow limits to give it full defense. It may only be remarked that if this view be accepted there is no greater lesson to teach a student than that, contrary to commonly accepted conservative views, the future in which he will live his life will not be like either the present or the past. The direction of movement in the future may, however, be indicated by the evidence drawn from a careful scrutiny of history.

In preparation for later life, the well-

trained student of history will look forward with a definite expectation of shifting lines, and should be prepared for those situations in which judgment may be exercised either to accelerate or to retard the natural movement of progress. The laws of history show us a normal instability which should be recognized and capitalized. We should expect to interpret the trend of events. The gift of intelligence puts before us the opportunity to help naturally with normal progress. The possibility which increased knowledge gives for greater evil does not mean that evil must therefore be done. It is only an evidence of wider range of capacity. It is scarcely conceivable that with all the consequences clearly understood real intelligence could permit the following of a path that would lead to its own destruction.

It is difficult to discuss the influence of culture in the broader sense upon science and research, or the relation of these two elements with the current reversed; but in the hope that the effort will be understood as an attempt to view the problem constructively, I venture to suggest what seem to be some of the normal interactions.

Let us assume for immediate purposes of this discussion that the essence of research is the attempt to understand, organize, utilize and increase our store of knowledge. The only persons who are not believers in the value of research are those who studiously keep away from the borders of knowledge. To one who has investigated in any subject our painful limitations are only too evident. The successes of research in every field within the past decade show that the possibilities open more widely with every discovery. One of the most dangerous types of people we may have engaged in handling affairs of moment is that which assumes all useful knowledge to be comprised within the facts already assembled and fails to recognize the possibility of progress in nearly every direction in which we choose to investigate.

Progress in discovery and in constructive thought has increased our social inheritance so rapidly that the luxuries of one age often become necessities of the next. If life is defined as a form of motion, true living in the human sense is a state of motion in which the conditions seem not fully satisfied without a kind of advance which we call progress. I doubt whether happiness is possible without a sense of accomplishment, either individually or socially. Research by bringing a stream of new materials into application serves as one of the most important agents for making human progress and happiness possible.

In order that we may know the materials with which we are to work in the future, education must present organized and simplified knowledge to each incoming generation. In addition to pointing out what is already known it is the duty of the university to indicate the direction in which progress may be expected or desired. It is important that special stress be laid upon the kind of thought and the methods necessary for progress in order that the future investigator may do his part. Among the greatest teachers within or without the university we rank those who have set forth not only what is known but also what should be known and should be done. In general they have shown the way by example as well as by precept and have been among those advancing exploration, discovery and philosophic interpretation.

I believe that the lessons of history suggest continued advance or progress of the human type, both in social organization and in physical being. Social evolution represents an unbroken train of experience and therefore gives the greatest possibilies for accumulation of power and of opportunity to use it. In this type of evolution research is the most effective instrument employed. Physical evolution is related to replacement of individuals in the succession of generations. Without physical advance the limits set for mental capacity in individuals will mean the ultimate attainment of a level of social evolution beyond which we may scarcely reach; but what I see of history expands my optimism to accept the view that nothing within our horizon of information gives evidence that the final stage of physical betterment is yet in sight. I do not believe that with increasing knowledge we shall lose such opportunity for advance as may still be open to us.

Research in science has suffered severely, both within and without the university, by reason of failure to recognize the magnitude of the field in which it operates and the interrelation of the elements comprised in it. The researcher must, by definition, be a specialist, in that he should understand more fully than any other person the height or depth or breadth of a particular element or law of nature. Narrow specialization is often considered to represent research, and contraction of the limits of investigation is not infrequently desirable. But the greatest specialist does not merely go up high or down deep. He sees from these advantageous positions the real significance of his explorations. If he proceeds far in any direction without interpreting what is learned in terms intelligible to others, the journey has been merely a personal excursion and not a contributing voyage of discovery.

I come therefore to speak particularly of the need for contact between research and culture, in order that the broader human relation of culture and scholarship may bring to research a better power of expression and a deeper interest in its ultimate significance, thus making more useful the fruits of discovery. Research may profit greatly by contact with every human interest involved within the wide comprehension of culture. Much of the material uncovered by constructive work in science has not reached utility or become real contribution to humanity by reason of the view that investigation is complete without interpretation, or that it is an end in itself without regard to human use or meaning.

Science and research have missed great opportunities because of aloofness from the more strictly humanistic aspects of investigation extending into the realm of culture. Problems of research have so multiplied within the field of natural science that there has perhaps been good reason for our failure to discover that the most complicated, and therefore in many ways the most attractive problems possible to the investigator are above and beyond those which have mainly engaged our attention. Important as are the nature of matter, chemical affinity and organic evolution, some of the greatest fields for discovery still relate to the fundamental understanding of human behavior and cultural interests, both in the individual and in the group sense. With adequate cooperation between the scientific investigator and the humanist research should advance rapidly in the study of man and his cultural expression. Investigation of the physical basis of mental action may never produce such results as have recently revolutionized natural science. On the other hand, it may be that human research will go farther beyond our present knowledge than radioactivity has carried us forward in physics. Are we to believe that man, probably the most complicated of all objects or instruments in the universe, may be neglected as the object of research by reason of his high level of development? Is it not clear that added knowledge, such as should be secured by united effort of the scientific investigator and the humanist, would give further control of our powers and greater satisfaction in their use?

It is with the hesitation of one known as a representative of the scientific school that I touch upon the other phase of the problem, namely, the possible contribution of research to culture and scholarship. If I were to indicate what might from my point of view seem a dangerous element in scholarly and cultural studies as contrasted with the situation in science and research, it would be to suggest that there is not in any branch of knowledge a finished chapter or a closed book, and that there is no field in which the principle of growth and progress may not be expressed profitably through constructive work. Culture must in some measure stand for conservatism and precedents. Theology tends by definition to be one of the most rigid of all phases of human thought, but scholarship stands next in rigorous adherence to standard. This condition is natural. Even the normal instability of evolution shows generally a stately and unhurried movement which illustrates the idea of standards in rate of change. The researcher states, "There is more unknown than known"; the scholar says, "We have before us only the known and must therefore base our practical lives upon it."

Scholarship in a passive or conservative position diminishes its value. Culture not merely sets standards of form but may also indicate the rate of progress. It may not only require that we know the best from the past, but should demand the best that can be secured in the present and future. The study of human actions and interests is not to be limited by assumption that creation, even in the human sense, is ever complete, or that existing states of law or culture are final. Science and research should be tied to the humanistic group of agencies for a combined investigation of problems of every kind relative to man. Culture should be a constructive force with the authority of history, and an active source of ideas and ideals.

Research and cultural activities not merely overlap and have common aims, but their highest expression develops through influence of similar types of constructive ideals. The idealism which gives life and hope to culture and science may be academic, unprofessional, or even unfashionable, but it has contributed much toward securing the present privileges of humanity. The practical man insists that he is limited by what is and not by what might be. The idealist dwells upon what should be, with the hope that what is, by reason of its instability and by virtue of the laws of change, may ultimately come to be the thing desired. The practical man with his hands tied by what he *must* do sets precedents and limits which sometimes bind the wheels of progress. The idealist, with the widest view of unity and movement reaching through the universe of being and of thought, visualizes the larger possibilities and helps to sweep away obstacles in the path of advance along lines of natural development.

And so, without further expansion of this view, it is clear that I do not hope to see less diversification in university activity but only more unity. We should represent here every type of thought. We must assemble, organize, interpret and construct in every region over which knowledge may extend. We must have differing types of mind and multifarious points of view. With meticulous refinement of technique some will seek out the minutest details of obtainable information and set them in order with relation to the ocean of available facts. Some will work upon the nature of matter and others on the theory of the state. But with all this differentiation, the principles of unity, or law, and the interrelation and interdependence of all knowledge should everywhere be recognized and made the basis of advance in thought. The delight in construction and the joy in expectation of progress should be lessons of experience which no one could fail to understand. Culture and scholarship should help science and research to better orientation. The explorer and builder should be imbued with that culture which gives the clearest vision of the road for human progress.

We must not forget that for each individual the end and aim of university effort is the securing of that knowledge which fits him into the niche in which he may perform the largest service; and that the university is not an apprentice shop, but is a source of ideals and a type of environment peculiarly fitted for growth of constructive minds. Let us be clear that whatever the university gives represents wasted time, effort and material, unless it is received in a spirit of reverence and with the idea that the greatest satisfaction lies in service as a builder who does not work for personal ends. It is said that geniuses are born, not made; but those who come into the world to live non-contributive, purely individual lives, leaving the world no better than they find it, we may truthfully say are only made, not born. Contribution to meet real human needs gives perhaps the only way by which we obtain full right of recognition as individuals in the strictly human sense. We may not know why living things must grow if they would live, or why history has given a choice between progress and oblivion, but the thinking world has always recognized the validity of this view.

We remember that the Great Teacher explained to Nicodemus the Pharisee: "Marvel not that I said unto thee, Ye must be born again." With all the spiritual meaning that this saying carries may it not suggest to us also that constructive service gives, with a sense of reality, a new and true life, a verifiable personality in the kingdom of creative beings. What greater work can a university perform than through its vision, its constructive power

and its culture to open the way to that kind of service which brings the joy of progress and the continuing rewards of real accomplishment.

JOHN C. MERRIAM

CARNEGIE INSTITUTION OF WASHINGTON

THE WORLD'S SUPPLY OF IODINE IN RELATION TO THE PREVENTION OF GOITRE[1]

OWING to the varying reports as to the concentration of iodine in sea water, I have made a number of determinations on water dipped from the Santa Monica, Cal., pier. Even after filtration, this water contained so much colloidal material as to interfere with the determinations. It was finally observed that thorough shaking with carbon tetrachloride and filtration removed this sufficiently to make analysis possible. The carbon tetrachloride was purified by the addition of a drop of bromine, action of sunlight and shaking with an excess of sodium thiosulfate solution. In determining this excess, some very dilute sodium carbonate solution was poured into the carbon tetrachloride and tenth normal sodium thiosulfate run in, about half a cc. at a time, followed by shaking, until the color disappeared. This solution was separated off and more carbonate and about two cc. of thiosulfate added with thorough shaking, followed by separation of the water phase. The carbon tetrachloride was then dried and distilled, the first distillate being rejected.

It was found that evaporation of the sea water until sodium chloride began to crystallize out made it acid, due to precipitation of calcium carbonate and the hydrolysis of $MgCl_2$, magnesium being a weak base, but there was no loss of iodine. Furthermore, a dry salt could be made of the sea water, without appreciable loss of iodine. This was accomplished by evaporation until the calcium carbonate precipitated; precipitation of the remaining calcium and magnesium by the addition of 100 cc. of seven per cent. Na_2CO_3 solution for each liter of original volume; filtration; washing the precipitate on the filter and evaporation of the filtrates to dryness.

In the analysis of the iodine content of salt, it was dissolved in water and the same procedure followed as with brine. In analyzing water or brine, standard solutions of the same NaCl content but varying concentrations of iodate were made up and treated in the same way as the unknown. The quantity of reagents added varied with the samples, and no portions were thrown away until the yield of iodine was found to be complete. Each sample if not near neutrality, was neutralized, using test paper, and about 10 cc. of concentrated HCl per liter added. In case buffers were present, at least enough acid was added to react acid to brom-phenol-blue (or methyl-orange). An excess of arsenious acid was added to reduce the iodate to iodide, the equivalent of 1 to 10 cc. of tenth normal per liter, and allowed to stand 20 minutes or more. At this stage colloids, if present, were removed. One per cent. sodium nitrite solution was added to the extent of ten times the quantity of arsenious acid. The sample was then extracted with several portions of carbon tetrachloride, which were then collected in a separatory funnel. In cases of 0.04 milligram per 100 cc. of the sample, a pale pink color could be detected in the carbon tetrachloride. The smallest workable quantity, often 1 cc. of very dilute (less than 0.1 per cent.) sulfurous acid was shaken with the extract until complete extraction of the iodine was effected. The carbon tetrachloride was removed from the sulfurous acid solution and a drop of concentrated sulfuric acid added, followed by sufficient sodium nitrite solution to oxidize the sulfurous acid and completely oxidize the iodide to iodine. The iodine was extracted with a sufficient quantity of carbon tetrachloride to fill the colorimetric apparatus (which varied in nature with the size of the yield) and compared with the standards. There must be nearly the same quantity of iodine in the final standard taken for comparison as in the unknown, and the treatment must be identical, quantitatively, especially in regard to volume relations and thoroughness of shaking.

The quantity of iodine found in the sea water was 0.05 milligrams per liter, which is a confirmation of the findings of Winkler for

[1] From the Southern Branch, University of California, and the University of Minnesota.

Adriatic sea water. Winkler probably had less decaying organic matter in his samples than were present in mine, as he makes no mention of difficulty on account of the presence of colloid material.

A sample of water which I dipped up from the Saltair pier, in the Great Salt Lake, Utah, contained only 40 per cent. more iodine than in sea water although the chlorine concentration was about 500 per cent. greater than in sea water. Since the Great Salt Lake is the residue left from the evaporation of Lake Bonneville, which was 1,000 feet deeper than the Great Salt Lake, and received practically all of the drainage of the Great Basin, covering Utah and parts of neighboring states, we have here a demonstration of the small quantities of iodine that are given up in the weathering of both igneous and sedimentary rocks.

Practically all of the iodine of the earth's surface is in the sea, which contains about sixty billion metric tons of iodine in the form of inorganic salts. This iodine probably entered the sea at the time chlorine accumulated in it. Iodides were probably the most soluble salts on the earth's surface, chlorides being next in solubility. If the earth was once hot on the surface, it is probable that hydriodic acid existed in the atmosphere and was washed into the sea with the first rain. Insoluble iodides of heavy metals are considered by Emmons to be secondary formations, due to the seepage of sea water through ores.

Judging by the prevalence of goitre, there is often a deficiency of iodine in our food and drink. At present, so little is known about the exact quantities of iodine taken into our stomachs that we can judge only by the number of cases of goitre. Omitting the details of local distribution of goitre, there is a wide goitre belt extending north along the Appalachian mountains to Vermont, thence west through the Great Lakes region to Montana and Washington and turning south it finally includes all of the Rocky Mountain and Pacific states. In fact, the goiterous belt includes the mountainous and glaciated regions. Since the run-off from mountainous and glaciated regions has carried away so much of the soluble material, it seems likely for this reason in addition to other evidence that the goitre belt is a low iodide belt.

Since the goiter belt includes large cities and millions of population, it seems unlikely at present that all of its inhabitants will receive iodide medication in pure form. Since the sea contains the bulk of the supply, the transfer of iodine from the sea to our food or drink should be increased. Perhaps the most attractive method is the inclusion of sea-foods in our diet, but this is limited. Dr. Turrentine of the Kelp-Potash Plant at Summerland, Cal., informs me that powdered kelp, when added in small amount to food can not be tasted and when added in larger amount imparts a pleasing taste to it. Since it is richer in iodine than ordinary sea-food and is relatively abundant, it should be an important source of iodine in our diet. Since sea water and salt-deposits contain iodine, salt might be made an important source of iodine in our dietary scheme. Blood and shell fish are about the only foods that do not require the addition of salt to make them palatable and fill our physiological needs, and hence the presence of iodine in salt would insure its universal consumption. Mr. O. S. Rask and myself failed to find iodine in any one of a number of samples of salt examined. Salt could easily be prepared from sea water as described above with the retention of the iodine compounds and at a cost not exceeding that of present-day table salt. Some of the magnesium carbonate precipitated from it could be added later if it be desired to make a shaker-salt, but from a nutritive standpoint, the addition of calcium phosphate for this purpose is highly desirable.

J. F. McCLENDON
UNIVERSITY OF MINNESOTA

INTERNATIONAL MEETING OF CHEMISTS AT UTRECHT

AT Utrecht on June 21 to 23, there was held the first gathering at which chemists from Germany and Austria have met with chemists from England, America and other countries for the presentation and discussion of scientific papers. The following persons were present: America: L. M. Dennis, D. A. MacInnes, W. A. Noyes.

Austria: E. Abel, J. Billiter, F. Emich, A. Kailan, A. Klemenc, F. Pregl, A. Skrabal, R. Wegscheider. Czecho-Slovakia: J. V. Dubsky, A. Simek. Denmark: N. Bjerrum, J. N. Brönsted, J. Petersen, Chr. Winther. England: E. C. C. Baly, F. G. Donnan, W. C. McC. Lewis. Germany: M. Bodenstein, G. Bredig, O. Hahn, P. Pfeiffer, R. Schenck, W. Schlenk, A. Stock, P. Walden, H. Wieland. Holland: J. Backer, J. J. Blanksma, Ernst Cohen, A. F. Holleman, F. M. Jaeger, H. R. Kruyt, W. Reindeers, P. van Romburg. Latvia: M. Centnerschwer. Russia: N. Schilow. Switzerland: J. Piccard.

The original suggestion of the meeting was made by Professor Donnan of London and preliminary plans were made at a meeting in the home of Professor Cohen of Utrecht in June, 1921. The details were carried out by Professor Cohen.

The following scientific papers were read and discussed:

E. C. C. Baly (Liverpool): Photochemical Catalysis.

P. Walden (Rostock): Ueber freie Radicale.

W. A. Noyes (Urbana): Positive and Negative Valences.

W. Schlenk (Berlin): Beiträge zur Chemie der freien Radikale und über den wechselnden Affinitätswerth der Kohlnstoffverbindung.

M. Bodenstein (Hanover): Die photochemische Bildung von Phosgen.

L. M. Dennis (Ithaca): The Preparation and Properties of Metallic Germanium.

H. Wieland (Freiburg i. B.): Ueber freie Radicale.

N. Schilow (Moscow): Vertheilungs-gleichgewichte.

J. Piccard (Lausanne): Absorptionsfarben zweiter Ordnung.

E. Abel (Vienna): Ueber direkte und indirekte Esterbildung in absolutem und wasserhaltigem Glyzerin (Nach Versuchen von Karl Heidrich).

A. Klemenc (Vienna): Dampfdrucke isomerer Benzolabkömmlinge.

M. Centnerschwer (Riga): Vorschlag zur Einführung einer kleinen Masseneinheit (Radion).

At a reception in Hotel Pays-Bas, Wednesday afternoon, there were addresses of welcome by G. L. Voernman, president of the Chemical Society of Holland, by Professor Went, president of the Royal Academy of Science of Amsterdam, and a response by W. A. Noyes, of Urbana.

The delegates were royally entertained at luncheon and at dinner each day, and on Friday there were tea and a reception given by Count van Sanderburg in his palace.

The gathering was not only for the purpose of promoting the development of chemistry through the discussion of topics of common interest by men from widely separated countries, but it was also a frank attempt to renew old friendships and form new ones between men of nations recently at war. Expression of a desire to promote permanent peace met with a hearty response.

RESPONSE BY W. A. NOYES, UTRECHT, JUNE 22, 1922

It is a great pleasure to be present at this international meeting in Holland. Last year you sent to us in America a fine representative in the person of Professor Cohen. When he was at our university in Urbana, we not only listened with great interest to the account he gave of the fine scientific work which he is doing in the van't Hoff Laboratory but we were also glad to hear of the scientific and intellectual life of your universities. We were particularly impressed by a statement he made to us about the Nobel prizes. You have here some five million people—some one says six million—I do not know very accurately—but he told us that you have received in Holland five Nobel prizes for scientific work. We in America have somewhat more than a hundred million people and we have received two prizes for such work. I am sure no other country can show such a record as Holland of nearly one prize for each million of her inhabitants. Professor Cohen also told us a part of the secret of your unparalleled work in science. He said that it is written in the fundamental laws of your state that the universities are founded to train men for the service of the state and also to train them in the methods of research. You have reason to be very proud of the way in which the spirit of your law has been carried out.

We are here for serious scientific discussions but there is another thought very much in the minds of every one. For the first time there

is gathered here an international group of chemists from nations that were on opposite sides during the great war.

On my last day on the other side of the Atlantic I spent a few hours in Quebec. There, many years ago, two great generals fought each other on the Plains of Abraham. Those generals both died in the battle and there on the front of the Parliament House I saw the statues of Wolfe and of Montcalm standing side by side. In that Parliament House meet the representatives of a nation part of whose people still speak French and part of whom speak English. Those two statues are, to me, prophetic of that which must come if Europe will not destroy herself. We are learning during these days the help which comes from talking over our scientific problems together. There is almost no limit to the advances which the world may make if nations can be willing to live together at peace. I have a great hope that states will learn those same lessons of the value of international cooperation and helpfulness that scientific men learned long ago. Let us hope that our meeting may contribute a little toward that end as well as do something for the advance of chemistry.

SCIENTIFIC EVENTS

THE ROYAL SANITARY INSTITUTE

THE *British Medical Journal* reports that the thirty-third congress of the Royal Sanitary Institute, which was held at Bournemouth from July 24 to 29, was attended by some 500 persons, including delegates from the British dominions and colonies and from many foreign countries, as well as by representatives of government departments, county and town councils, and other public bodies. The president of the congress was Major General J. E. B. Seely, M.P., who in his presidential address protested against economies at the expense of the public health, and said that the three very important principles which lay at the basis of the congress were, first, the vital necessity of the health of the people to the maintenance of the British Empire; second, that national health required the organization of all the various agencies; and third, that the health policy of the nation should not be merely the prevention of disease and premature death, but the increase in human capacity and happiness. Great advances had been made in the provision of cleaner towns, better sanitation, good water supplies, food control, drainage and sewerage, but not enough had been done for the education of the people in a healthy way of life. The housing problem could be solved only by steady and persistent work in every district over a number of years. Curtailment in the school medical service had been spoken of in the interests of economy, but he considered that that service was not only saving the lives of hundreds of children, but was laying the foundation for a healthy nation in years to come. Meetings for the reading and discussion of papers were held in five sections: Sanitary Science, Engineering and Architecture, Maternity and Child Welfare, including School Hygiene, Personal and Domestic Hygiene, and Industrial Hygiene. In the Section of Sanitary Science a discussion was held on methods of securing continuous treatment of persons infected with venereal diseases, in which papers were read by Dr. J. Johnstone Jervis, Dr. W. E. Facey, Mr. Kenneth Walker, and Dr. Joseph Cates. In the Section of Maternity and Child Welfare including School Hygiene, papers were read by Dr. John Robertson on the regulation of the distribution of milk and food at maternity and child welfare centers, and by Dr. D. C. Kirkhope on certain preventive and curative aspects of the school medical service. Papers were also read on different aspects of maternity welfare by Mr. Aleck W. Bourne, Dr. R. Veitch Clark, and Dr. R. J. Maule Horne. In addition to the meetings of the sections, a number of conferences were held of sectional representatives, such as sanitary authorities, medical officers of health, engineers and surveyors, veterinary inspectors, sanitary inspectors and health visitors. The popular lecture, on "The value of clean fresh air," was delivered by Professor Leonard Hill, F.R.S., who said that physiologists could help greatly to point the way to a happy and healthy life, but ignorance and custom enveloped the people, and it was problematical whether our civilization might not stifle itself like older civilizations and die out. The discipline and the laws

of health, which included moral restraints, alone could save it.

THE FRENCH DYE INDUSTRY[1]

THE issue of *La Nature,* April 15, contains an interesting summary of the French dyestuff industry, particular attention being paid to progress made since 1914. In 1913, 2,000 tons of dyes, of the value of seven million francs, were imported. Eighty-five per cent. came from Germany and ten per cent. from Switzerland. The balance of the consumption of 9,000 tons represented French manufacture. It is pointed out, however, that the dyestuff factories of France, of which there were four, were almost completely dependent on Germany for intermediates, the home production of which represented scarcely ten per cent. of the requirements. There were in addition German works which received intermediates or even finished dyes from Germany. The article refers to the ready adaptation of the dye works in Germany to the manufacture of munitions during the war, and does not omit to point out that, without the means of obtaining synthetic nitric acid, which the enemy had also perfected, his dye works would not have been of the slightest use to him.

The French efforts during the war are described at length. In April, 1916, the Syndicat National des Matières Colorantes was established, which had relations with the state and further arranged to take over after the war the national factories used in the manufacture of explosives. The Compagnie Nationale des Matières Colorantes et de Produits Chimiques was constituted in January, 1917, and at once set to work. Two factories rapidly grew up, the first at Nogent-les-Vierges on a semi-technical scale, and a large factory at Villers-St-Paul, with a contemplated capacity of 4,000 tons of synthetic indigo a year. This was abandoned during the German advance in 1918 and the material removed to Lyons, but it has again been set in operation, and, as a result of intensive work, the total production of the French factories had grown from 175 tons in 1919 to 765 tons in 1920. Since that time the production has decreased on account of the economic crisis, although the capacity of production is now stated to exceed 13,000 tons. With a few exceptions, dyes of all the main types are manufactured and progress is being made.

The company has two large centers of production. The Oissel Works, installed at the old national factory, with an area of 39,000 sq. m. of buildings, is connected with the main line from Paris to Rouen. The power is generated by turbo-alternators of the most modern type, each of 1,000 kilowatts. The factory is at present making intermediates, of which more than sixty are being produced, together with sulphur dyes and azo-dyes. These are produced directly from the intermediates without isolation of the latter from solution.

The second works is that at Villers-St.-Paul, with an area of 35,000 sq. m. of buildings, on the main line from Paris to Compiègne. A very modern boiler plant is installed, which when complete will consume 300 tons of coal daily. In this works are made the dyes which require special apparatus, such as indigo and alizarine, phthalic acid and basic dyes derived from it, triphenyl and diphenylmethane dyes, pyrazolone dyes, etc. Vat dyes are also made, and there are large research laboratories.

At Saint-Denis the old works has been enlarged, while a new works at Isère grew up during the war. It is stated that prices are now high owing to high costs of raw materials, and the yields could also be improved by the further efforts of the chemists, and particularly of the engineers.

[1] From *Nature.*

GOOD ROADS SCHOLARSHIP

NAMES of judges appointed to award the four years' university scholarship offered in connection with the national good roads essay contest are announced by the Highway Education Board.

The judges are: Henry C. Wallace, secretary of agriculture; George Horace Lorimer, editor of the *Saturday Evening Post,* and Dr. John Grier Hibben, president of Princeton University. The judges accepted responsibility for the award of the scholarship at the invitation of Dr. John J. Tigert, United States commissioner of education, who also is chairman of the board.

They have been supplied with copies of

fifty-four essays, representing each state, as well as the District of Columbia, the Canal Zone, the Philippines, Porto Rico, Hawaii and Alaska. Selection of the best essays, out of the thousands written in the states and territories, was made by leading educational institutions, such as a state university, or the state department of education.

It is estimated by officials of the board that at least 250,000 pupils of high school grade participated in the contest, and these fifty-four manuscripts, therefore, represent the cream of all papers presented. Essays were written on the subject, "How good roads are developing my community." In many states local prizes were given, as well as state prizes by the institutions conducting the contest.

The scholarship is given by H. S. Firestone, Akron, Ohio, a member of the Highway Education Board. It is intended to defray tuition and expenses of the student in college and is valued at not less than $4,000. The successful student, to be selected by the judges, may attend any college or university in the United States. It is expected that the judges will reach a decision in time to permit the successful boy or girl to enter college this autumn. The scholarship is given annually for the best essay on a subject pertaining to good roads.

THE ASSOCIATION OF IRON AND STEEL ENGINEERS

THE sixteenth annual convention will be held September 11 to 15, at Cleveland, Ohio. Following is the tentative program:

MONDAY, SEPTEMBER 11

9:30 A.M.

Business session—Election of officers.

2:00 P.M.

Report of Standardization Committees. F. W. Cramer, chairman.

Report of Sub-Committee on Motors. D. M. Petty, chairman.

Report of Sub-Committee on Lighting. R. G. Bauer, chairman.

Report of Sub-Committee on Control. F. W. Cramer, chairman.

Report of Sub-Committee on Cranes: "Résumé of AI&SEE Crane Code." R. S. Shoemaker, chairman.

Report of Sub-Committee on Transmission: "Investigation of Insulators for Steel Mill Service." A. R. Leavitt, chairman.

Report of Electric Development Committee. R. B. Gerhardt, chairman.

Report of Electric Furnace Committee. E. T. Moore, chairman.

Report of Safety Committee. "Safety Organization—General Safety Rules." F. A. Wiley, chairman.

TUESDAY, SEPTEMBER 12

9:30 A.M.

"Generating Station Development": D. B. Rushmore and E. Pragst.

2:00 P.M.

"Electrification of the International Nickel Company's Works for Monel Metal": F. C. Watson.

WEDNESDAY, SEPTEMBER 13

9:30 A.M.

"Steam Turbine Operation": L. W. Heller.

"Internal Combustion Engines for Power Generation in Steel Mills": D. M. Petty.

2:00 P.M.

"Judging the Combustion of Gaseous Fuels from Gas Analysis": A. G. Witting.

Topical Discussion—"Boiler Practices of 1922": J. B. Crane, E. R. Fish, Alfred Cotton, R. E. Butler, R. M. Rush and P. H. Falter.

THURSDAY, SEPTEMBER 14

9:30 A.M.

"A Review of Steel Mill Electrification": B. G. Lamme and W. Sykes.

2:00 P.M.

"Improvement in Efficiency of Electric Power Supply": Dr. C. P. Steinmetz.

7:00 P.M.

Sixteenth annual banquet.

FRIDAY, SEPTEMBER 15

9:30 A.M.

"Some Considerations in the Electrification of the Steel Plant Railroad Yard": R. B. Gerhardt.

2:00 P.M.

Inspection trips—Cleveland industrials.

SCIENTIFIC NOTES AND NEWS

THE centenary of the death of two distinguished astronomers occurred last month. William Herschel died on August 25, 1822, and Jean Baptiste Joseph Delambre on August 19.

AT the meeting of the French Association for the Advancement of Science, held at Montpellier from July 24 to 29, M. Mangin, director

of the Paris Museum of Natural History, gave the presidential address on the "War against the enemies of plants." M. Desgrez presided, and M. Viala was chosen to succeed him in the presidency. The meeting next year will be at Bordeaux.

M. BERGSON presided at the two sessions of the Committee on Intellectual Cooperation of the League of Nations that met at Geneva on August 1. Reports were presented by M. de Reynold, of Switzerland, and Mme. Curie, of France, respectively, on the situation in Austria and in Poland. The question of international cooperation in bibliography was discussed and a committee was appointed consisting of M. J. Destrée, of Belgium, M. de Reynold, Miss Bonnevie, of Norway, and Mme. Curie.

THE astronomers who are visiting Australia for the eclipse were given a civic welcome on August 8 by the Lord Mayor of Melbourne and afterwards entertained at luncheon by the federal ministers at the Federal Parliament. The prime minister expressed the willingness of the government to afford the utmost facilities to ensure the success of the expedition. Dr. W. W. Campbell, director of the Lick Observatory, replying, said that Australia had shown greater interest and rendered more assistance than the government of any other country for previous expeditions with which he had been associated.

HENRY EDWARD PELLEW, of Washington, has become Lord Pellew, the sixth viscount of Exmouth, at the age of ninety-four years. The title will devolve on Dr. Charles E. Pellew, of New York, formerly associate professor of chemistry in Columbia University.

DR. ROBERT AITKEN, astronomer, Lick Observatory, has returned from the meeting of the International Astronomical Union which was held from May 2 to May 10 at Rome. Dr. Aitken acted as chairman of the commission on double stars at the international meeting and was re-appointed chairman of the commission for the period 1922-25. He was also made a member of the commission on positions and orbits of minor planets, satellites and comets. Dr. Aitken took part in the meetings in celebration of the centenary of the Royal Astronomical Society of London which were held from May 28 to May 31 in London. While there Dr. Aitken had the honor of presenting the Bruce Gold Medal of the Astronomical Society of the Pacific to the astronomer royal, Sir Frank Watson Dyson.

DR. J. S. KINGSLEY, who has been on leave of absence for the past year, has retired from the faculty of the University of Illinois with the title of professor emeritus of zoology. His address for the future is 2,500 Cedar Street, Berkeley, California.

PROFESSOR G. A. MILLER, of the University of Illinois, has recently been elected an honorary member of the Indian Mathematical Society. This society was organized in 1907 and its membership list, dated 1922, includes about 200 names. It then had only one honorary member.

PROFESSOR L. BAIRSTOW has been elected chairman of the Royal Aeronautical Society in succession to Lieutenant Colonel M. O'Gorman.

A. W. AMBROSE, chief petroleum technologist of the United States Bureau of Mines, has been appointed assistant director of the bureau, to fill the vacancy created by the resignation of E. A. Holbrook, who has accepted the deanship of the mining school at Pennsylvania State College. The duties of F. J. Bailey, assistant to the director, have been increased by assigning to him virtually all the business matters of the bureau formerly handled by the assistant director.

COLONEL DELCAMBRE has been appointed director of the French Meteorological Office.

HAROLD E. BABCOCK, of Cornell University, has resigned his position in the department of farm management and agricultural economics of the College of Agriculture to become manager of the Cooperative Grange League Federation Exchange.

DR. D. I. ANDRONESCU, of Emerson, New Jersey, has accepted a position with the Department of Agriculture of Romania as chief of the department of plant breeding. His address will be Statiunea Agronomica, Baneasa-Bucuresti, Romania.

AMONG the British civil list pensions granted "in consideration of their circumstances" during the year ended March 31, 1922, and announced in *Nature* are: Lady Fletcher, in recognition of the services rendered by her late husband (Sir Lazarus Fletcher) to science, £60; Dr. Francis Warner, in recognition of the services rendered by him in his investigations into the mental and physical condition of defective children, £100; Sir George Greenhill, F.R.S., in recognition of his services to science and his ballistic work, £125; Mrs. J. M. Miller, in recognition of the services rendered by her late husband (Dr. N. H. J. Miller) to agricultural science, £50; Mrs. Alice Mabel Ussher, in recognition of the services rendered by her late husband (Mr. W. A. E. Ussher) to geological science, £50; Mrs. Agnes E. Walker, in recognition of the services rendered by her late husband (Mr. George W. Walker, F.R.S.) to science, £75; the Misses Ellen C., Gertrude M., Alice B., Katherine E. and Mary L. Woodward, in recognition of the services rendered by their late father (Dr. Henry Woodward, F.R.S.) to geological science, £125.

ACCORDING to the *Journal* of the Washington Academy of Sciences, at a meeting of the executive committee of the Institute for Research in Tropical America it was decided to concentrate the efforts of the institute on the establishment of a research station in Panama near the Gorgas Memorial Institute which is to be erected in the outskirts of the city of Panama. The members are Thomas Barbour, Harvard University; H. E. Crampton, Barnard College (representing the New York Academy of Sciences); A. S. Hitchcock, Smithsonian Institution; A. G. Ruthven, University of Michigan, and Dr. Witmer Stone, Philadelphia Academy of Sciences.

M. DANIEL BERTHELOT, professor of physics in the University of Paris, gave the lecture at the joint meeting of the five French academies held on July 17.

DR. STEPHEN SMITH, distinguished for his contributions to public health, died on August 26, in his ninety-ninth year.

GISBERT KAPP, born in Austria in 1852, professor of electrical engineering at the University of Birmingham, died on August 10.

MRS. J. A. OWEN VISGER, author of books on natural history, died in London on July 30, at the age of eighty years.

HANS BATTERMAN, at one time director of the astronomical observatory at the University of Königsburg, has died at the age of sixty-two years.

M. LOUIS FAVÉ, known for his work on oceanography, died on July 31 at the age of sixty-nine years.

THE third annual meeting of the Southwestern Geological Society will be held at Dallas, Texas, on September 15 and 16. Visiting geologists, who are in that part of the southwest are invited to be present at this meeting.

THE Gutiérrez prize of 400 pesos will be awarded by the Havana Academy of Sciences for the best work on the medical geography of some part of Cuba. The Cañongo prize of 200 pesos is offered for the best work on any scientific subject, and the Gordon gold medal for the best work on the "Physiological conception of sleep." The competing articles must be sent in anonymously, and be in the hands of the secretary before March 30, 1923.

AN institute of theoretical and applied optics has been established at Paris with a course lasting two years and a laboratory for research. A monthly journal has been established with the name *Revue d'optique théoretique et instrumentale,* which has the cooperation of the French syndicate of makers of optical apparatus and instruments of precision.

Nature states that a new biological station for the study of limnological problems and for research on the development of fresh-water fishes has been established at the Lake of Trasimeno, in Umbria. The University of Perugia has assumed responsibility, and the director of the station is the professor of physiology, Dr. Osvaldo Polimanti.

ACCORDING to *The Experiment Station Record,* the entomological laboratory and offices of the Station Agronomique de la Guadeloupe were recently destroyed by fire. Among the material lost was the mailing list, and the sta-

tion asks to be informed of individuals and institutions desiring to continue to receive its publications. Correspondence should be addressed to the director, Station Agronomique, Pointe-à-Pitre, Guadeloupe, West Indies.

AT the meeting of the American Psychological Association at Princeton in 1921, there was constituted a Section of Consulting Psychologists to represent persons able to carry on the applications of psychology at a recognized scientific level. Up to the present, the membership in this section has been restricted to members of the Section of Clinical Psychology. Applications for membership to the Section of Consulting Psychologists can now be received from all members of the American Psychological Association who are engaged in the applications of psychology. The committee in charge will act upon these applications at the next annual meeting of the association. For further information address the representative of the committee, Dr. F. L. Wells, 74 Fenwood Road, Boston, Mass.

THE Wintersteiner Collection of 13,000 microscopical preparations of eye pathology has been acquired by the St. Louis University through the generosity of Mr. Charles Rebstock, of St. Louis. This collection, which is said to be the most complete in Europe, will be utilized for graduate instruction in ophthalmology.

IT is proposed to build an observatory on the top of the Jungfrau. The Swiss Meteorological Bureau has carefully studied the proposal, and decided that should the observatory be erected it ought to be placed on the Sphinx rock. The rock stands above the Jungfraujock at the height of 11,721 feet, 388 feet higher than the Jungfraujock railway station. The observatory, which would be intended for meteorological observation, should, owing to its altitude, prove important and useful. Its construction, however, would involve a great expense, but it is hoped that the state and the scientific bodies of Switzerland will contribute towards its erection.

IT is stated in *Nature* that the British Research Association for the Woolen and Worsted Industries announce the following awards of research fellowships and advanced scholarships for the year 1922-23: Mr. G. W. Chester, Liverpool, £200 to conduct research on wool fats at the University of Manchester; Mr. John L. Raynes, Nottingham, £100 to conduct research on the bleaching of wool at the University College of Nottingham; Mr. George Barker, Baildon, £100, to conduct research on the action of water on wool as regards strength, elasticity, lustre, dyeing properties, etc., at the University of Leeds. Scholarships have been granted to Mr. Arthur Banks, Sutton Mill, Keighley, tenable at Bradford Technical College; and Mr. William B. Elliot, Wellington Road, Hawick, tenable at the South of Scotland Central Technical College, Galashiels.

THE *Journal* of the American Medical Association states that a deputation received on July 13 by the British minister of health laid before him the present status of graduate medical education in London. The committee appointed by Dr. Addison, former minister of health, recommended that an institute or college of hygiene be established in London. This has been made possible by the munificent gift of the Rockefeller Foundation, and furthered by a promise from the minister of health of an annual grant of £25,000 for upkeep. A site has been selected and other arrangements are in progress. It was further recommended that a graduate medical school be established to serve as a center of a great teaching organization, in which the special hospitals of London, the Poor Law infirmaries and the medical schools, with their clinical units and research departments, would all find their place. It advised that, as an integral part of the organization, there should be a bureau or central office controlled by a committee of management and providing a library, a hostel and full facilities for social intercourse. Nothing has been done to advance this second recommendation, and it is on this point that the deputation made representations to the minister. The president of the Royal College of Physicians of London, the president of the Royal College of Surgeons of England and the chairman of the committee on graduate education of the British Medical

Association, were among the members of the deputation.

THE program for the Eighth National Exposition of Chemical Industries, to be held in Grand Central Palace, New York, N. Y., September 11 to 16, 1922, numbers among its speakers not only many eminent chemists but several well-known public men. There are already about 400 exhibitors. Every branch of the chemical and chemical equipment industries, as well as numerous allied houses, will be represented at the exposition. The chemical products displayed will include all types manufactured in the United States: Coal, medicinals, and dyestuffs, technical chemicals for the rubber, leather, paper, textile, paint, and other consuming trades,—"everything in chemicals from the crudest of crude materials to the most delicate aromatic ready for the perfumer's use." A number of new devices in apparatus and machinery developed since the termination of war-time activity and completed since the 1921 Exposition will be displayed for the first time, as well as improvements on machinery long standard for industrial operations. Many of the machines will be seen in actual operation. Some new features which will be on display are: New special high-capacity evaporator; Lead pumps for handling phosphoric acid under pressure; new adaptation of the all hard-rubber pump for use in muriatic acid loading; recent development on a balanced automatic control valve and in direct reading resistance thermometer; new ideas in pyrometers; developments of the past year in butyl alcohol and furfural and their derivatives for solvent purposes; the use of liquid chlorine in the paper industry in place of bleaching powder; new dust controlling and humidifying equipment; new ideas for loading machinery on trucks; all types of containers, steel fiber, wood and glass.

THE *Journal* of the Royal Society of Arts states that because it represents an entirely new industry to Malaya, the formal opening of the pottery works at Gopeng, was made the occasion of somewhat elaborate ceremonies. The plant, which is situated about 16 miles from Ipoh, is equipped to handle all the processes from refining the crude clay to the decoration of the completed piece. According to a report by the United States consul at Penang, casting and jolleying are the processes used, permitting a comparatively large output with labor that is not yet thoroughly trained. Teapots, jugs, ewers and basins are already being turned out, notwithstanding that a few weeks ago the Malay girls employed in the casting room had never seen a pottery. As the available labor becomes more skilled the production of porcelain ware in bulk is contemplated. All the materials required for pottery making are found within three miles of the works. Besides supplying its own clay requirements, the company ships china clay to cotton mills in Bombay and paper mills in Calcutta. The barrels for packing the product are made at the works.

UNIVERSITY AND EDUCATIONAL NOTES

THE will of Arthur B. Emmons, of Newport, R. I., leaves $50,000 to the Museum of Fine Arts of Boston and $25,000 to the Children's Hospital of the same city, and the Newport Hospital. Berea College, Kentucky, Hampton Institute, Virginia, and Tuskegee Institute, Alabama, receive $10,000 each.

DR. ANDREW M. SOULE has resigned the presidency of the Georgia State College of Agriculture, to accept the presidency of the University of Wyoming, to take the place of Dr. Aven Nelson, who returns to his former position as head of the department of botany.

DR. J. L. BEESON, for twenty-five years professor of chemistry at the Georgia State College for Women, Milledgeville, Ga., has been elected acting president of the college.

WILLIAM F. G. SWANN, Sc.D., professor of physics in the University of Minnesota, has been appointed professor of physics at the University of Chicago. Professor Swann was connected with the Royal College of Science, London, and the University of Sheffield before coming to the United States in 1913. For six years he was chief of the physical division, Department of Terrestrial Magnetism of the Carnegie Institution at Washington.

DR. HENRY H. GODDARD, for the past four years director of the State Bureau of Juvenile

Research at Columbus, Ohio, has resigned to accept the professorship of abnormal psychology in Ohio State University. He will continue his clinical work and his researches in the abnormal field.

DR. J. BRONFENBRENNER, formerly assistant professor of preventive medicine and hygiene at the Harvard Medical School, has accepted a similar appointment in the department of bacteriology.

MR. JOHN L. BUYS, Ph.D. (Cornell, '22), has been made assistant professor of zoology in the Municipal University of Akron, Ohio., in the place of Dr. W. R. Allen, who goes to the University of Kentucky.

L. E. MILES, plant pathologist for the State Plant Board of Mississippi, has become associate plant pathologist and associate professor of plant pathology at the Alabama Polytechnic Institute.

DR. SIMON KLOSKY, of the research department, Edgewood Arsenal, Chemical Warfare Service, has been appointed instructor at the Martin Maloney Chemical Laboratory of the Catholic University of America.

DR. WALTER RITCHIE, assistant lecturer in biology in the University College, Aberystwyth, has been appointed assistant lecturer in biology at the Technical College, Bradford, in succession to Mr. L. P. W. Renouf, who has been elected to the professorship of zoology in the University of Cork.

DISCUSSION AND CORRESPONDENCE

RELIEF FOR RUSSIAN ASTRONOMERS

TO THE EDITOR OF SCIENCE: Complying with your request, I will make a brief statement as to the efforts which have been made by the American astronomers in recent months toward the relief of the physical needs of our colleagues in Russia.

Letters began to filter in from Russia about a year ago. We thus learned, for instance, that the grounds of the great Pulkowo Observatory had again been chosen as a field for artillery practice between rival factions. Fortunately, there had been a little intimation of what might happen, and no damage was done to telescopes or other apparatus, the most valuable lenses having been stored below the possibility of damage. The letters foreshadowed impending distress for the necessities of life, and the natural anxiety about the winter of 1921-2. Later letters showed that the anticipations were being realized with distressing completeness.

At the meeting of the American Astronomical Society held at Swarthmore, in convocation week, or about January 1, 1922, a Committee on Russian Relief was appointed, consisting of Professors J. A. Miller of Swarthmore, Benjamin Boss of Albany, and H. C. Wilson of Northfield. A generous subscription of about $150 was made at the meeting, principally for relief of astronomers at Pulkowo and for M. and Mme. Ceraski, formerly of the Moscow Observatory. The committee decided not to make further appeal for funds.

During the latter part of the winter the calls for help from the Russian observatories were numerous and beyond the means of the staff of any one observatory; consequently, after learning that the committee of the Astronomical Society had decided not to take further action, a small, informal committee assumed the responsibility and issued an appeal to the members of the staffs of the American observatories and departments of astronomy—having in mind that a monthly contribution might be given for five months, from the persons connected with our larger institutions.

Meanwhile, the American Relief Administration was extending its operations, and direct information was coming to us of the receipt of the food packets. An actual demonstration of the workings of the A. R. A. was hardly necessary, in view of the splendid efficiency of all relief work in which Mr. Hoover has had a hand.

In order to avoid any waste of time in correspondence between the members of a committee having proper geographical distribution, the three members were chosen from the same staff, and decisions could thus be reached immediately and appeals answered on the same day that they were received. One member of the committee is Russian, and thus our foreign friends were enabled to write their letters in

Russian, without the inconvenience of translating them into a language different from their own. The valuable personal acquaintance of this member in Russia was of great assistance in drawing up a list of institutions which ought to be reached.

The response to the appeal in America was immediate, and very generous. Up to August 15th, a sum of $1,657.47 had been received, and food packets amounting to $1,490 had been sent for distribution among the scientific staffs of twenty-five institutions, observatories or universities, and to some isolated astronomers or their dependent families. These packets were sent at intervals, considerably oftener than a month, as the funds came in for the purpose. We have received interesting testimony as to the care and judgment of the A. R. A. in the selection of contents of the food packets, having learned from the direct experience of our friends that a $10 packet has actually supported two persons for a month. It should also be recalled that one fourth of all packets was used for the general relief of Russian children.

The recipients of the first shipments were requested to give us the names of other astronomers or their families that might need assistance, and thus the list has been considerably increased. Many replies have been received, but not yet has there been time for all to acknowledge the receipt of the food packages. The distress has been very great in the Crimea —perhaps where it had been least expected— and it was not possible for the A. R. A. to establish warehouses in this district until rather recently. From six to eight weeks seems to have been necessary for the actual receipt of the food at points which could be reached most expeditiously.

The last general distribution of food packets was made at the end of July, and we have assumed that by the time it reaches the persons for whom it is intended the new harvest will have removed the immediate urgency of relief. The balance which the committee has in the bank will be used in responding to calls from individuals not yet reached, or those in remote districts where the distress may still be acute.

No expenses of the committee have been charged to the fund, so that the distribution has been net. This, of course, applies also to the splendid work of the A. R. A.

The followers of the stars are a scattered, other-worldly folk, but their work on far-away things has brought them close together. Personal acquaintances are probably closer among astronomers and their families than is the case in most other branches of science. It has, accordingly, been a simpler matter for the American astronomers to give this little help to their Russian colleagues than it would have been for those in other departments of endeavor having a greater constituency. Men and women of America in several other branches could readily have contributed a hundred times what the astronomers could do—and perhaps they have—but the presumptive lack of personal contact would have made this a rather difficult proposition. The letters from Russian astronomers leave no doubt as to the sincerity of the appreciation of even this small measure of relief from America.

The members of the committee have been: George Van Biesbroeck, Otto Struve and the writer.

EDWIN B. FROST,
Chairman

YERKES OBSERVATORY,
WILLIAMS BAY, WISCONSIN
AUGUST 18, 1922

BOTULINUS TOXIN

SOMETIME ago Dr. Schlesinger and myself (*Proc. Soc. Exp. Biol. and Med.*, 19, 1, 1921; *Jour. A. M. A.*, 78, 1519, 1922) stated that the toxicity of crude filtrate from cultures of *Bacillus botulinus* may be greatly increased by the proper degree of acidification (approximately p_H 4). When we tried to find the limits of potency of such an acidified solution of toxin, we were extremely surprised to discover that even such minute quantities of solution which contained only 3×10^{-18} cc. of the original culture filtrate exhibited all the specific properties of the original toxin and killed mice in less than 48 hours when injected intraperitoneally. When this acidified solution of toxin was diluted

further, the results became less regular, in fact the dilution containing 3×10^{-21} cc. of the original toxin killed only 5 per cent. of the animals tested.

In the current issue of SCIENCE (August 4, 1922, page 143), Dr. Stehle questions this observation. He states that one cubic centimeter of toxin does not contain enough molecules to supply a molecule of toxin for each cubic centimeter of the final dilution. Indeed, he rightly concludes that "the average 3×10^{-21} cc. quantity of solution would contain no toxin." We agree with Dr. Stehle's conclusion, but we think it offers an explanation of, rather than a contradiction to our findings.

Our findings do seem unbelievable. Moreover, in view of the fact that mice are not very reliable as test animals for toxicity, together with the possibility of some error in dilution due to inaccuracy of pipettes, we do not insist on the accuracy of the figures and offer them merely as the best proof of the apparent extreme increase of the potency of toxin—a condition unknown with other bacterial toxins. As a matter of fact, we doubted the figures obtained originally and repeated the experiment many times. Finally, we checked our finding by a calculation similar to that used by Dr. Stehle (in our calculation we followed the reasoning found in Walker's "Introduction to Physical Chemistry," Macmillan, 1907, pages 214-219). This calculation, in fact, gave us the audacity to offer our figures which before seemed to us ridiculous. According to our interpretation, this calculation showed that each cubic centimeter of the dilution of the toxin to the eighteenth power might still contain enough of the specific substance to kill mice regularly (over 80 per cent. of animals thus treated died within 48 hours and about 10 per cent. more died within the next 24 or 48 hours), whereas in the dilution to the twenty-first power, many of the one cubic centimeter portions of the solution might not have contained even a single molecule of toxin, which apparently explains why only 5 per cent. of the animals injected died. When identical results were obtained on at least three different batches of toxin, obtained on different lots of culture medium, and on repeated tests on each of these batches, we decided to publish these unusual findings. I wish to take this opportunity to add that we still expect to find some source of constant error in our procedure or in our calculation. We know of no good proof indicating that the toxin may act as a catalyst, nor are we willing without further good reason to believe in the existence in the body of some vital center consisting of a small group of cells (not more than 100 and possibly less), the injury to which would lead to death in 80 per cent. of animals tested. Furthermore, continuing the above calculation, we were forced to conclude that the molecular weight of such an active toxin as we have seemingly obtained when computed on the basis of total solids could be about 380 and when calculated as protein (on the basis of total nitrogen) could be no greater than 260, which makes it extremely difficult to see how such a simple substance can possess the degree of specificity in respect to antitoxin neutralization which our solutions demonstrated.

In order to clarify the question, I would like to sum up the arguments which seem to favor the validity of our observations.

(1) When 3×10^{-18} cc. of the acidified culture filtrate of *Bacillus botulinus* is injected intraperitoneally into mice of 17-21 grams, the animals die with all the symptoms of botulinus poisoning in mice.

(2) When receiving this small amount of toxin the animals die within 24-48 hours, which is a typical incubation period for botulinus toxin.

(3) Animals receiving protective injection of a homologous (type A) antitoxin invariably survive the injection of the amount many millions of times greater than 3×10^{-18} cc. of this active solution.

(4) The animals receiving large amounts of botulinus antitoxin type B (heterologous) are not protected even against a single dose of 3×10^{-18} cc. of acidified type A toxin.

(5) The potency of acidified toxin is destroyed by a very short exposure to heating at 80 degrees C.

(6) When the reaction of acidified toxin is brought back to neutral (before dilution), the resulting solution has the titer of the original toxin. The re-acidification and re-neutralization can be accomplished several times in succession with the result that acidification invariably increases the potency and neutralization returns it to the original titer.

(7) When one cubic centimeter of the original toxin has been distributed through a sufficiently large amount of a diluent so that not every cubic centimeter of the diluent would be theoretically expected to contain one molecule of original toxin, the results of the injection of such highly diluted toxin become irregular and apparently depend on the presence or absence of a molecule or a small number of molecules of toxin in each portion injected.

(3) While not every filtrate yielded an equally potent product on acidification, the same filtrate consistently titrated as indicated, even though repeated tests were performed several days and weeks apart.

On the other hand, it is evident that there are a number of considerations militating against the validity of our observations.

(1) Using the same strain of the organism and similar culture medium, it was not always possible to obtain the same degree of increase in potency of the acidified filtrates, although in all cases some increase was observed. Apparently, the uncontrollable differences in composition of the culture medium during the early growth of the organism has something to do with the degree of change in potency which the toxin will undergo upon its subsequent acidification.

(2) It is difficult to conceive how such a small number of molecules which can theoretically be expected to be present in the small amount of toxin injected can produce the effect.

(3) The extreme simplicity and low molecular weight which the active substance seems to possess according to calculation is difficult to reconcile with its strict biologic specificity which would postulate a more complex structure.

(4) We find that while this active toxin is neutralized by a specific antitoxin, the neutralization does not go according to the law of multiple proportions, but is in fact more efficient.

(5) It is difficult to explain why such a simple molecule as that which the active toxin seems to possess can not pass bacterial filters which are comparatively permeable to the original toxin.

These, as well as other considerations, indicate that a further study of the subject is necessary. We feel more inclined to believe, and some of our most recent observations strengthen this belief, that while the toxin does unquestionably undergo an increase of potency under certain conditions of the experiment, the degree of this increase probably is not as great as some of our findings seem to indicate. We suspect that there may occur an ultramiscropic precipitation of the toxin-carrying portion of the medium. If the minute particles of such a precipitate should possess particularly high adsorptive power, they could be carried from dilution to dilution and thus vitiate the accuracy of the calculation. Since circumstances force us to interrupt this study for the time being, we thought it worth while to call the attention of other workers to this interesting phenomenon. With this in view, we are preparing detailed protocols of the experiments to date which we hope to publish in the near future.

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SOIL SHIFTING IN THE CONNECTICUT VALLEY

RECENTLY two articles have appeared in the current volume of SCIENCE (Nos. 1413 and 1426), reporting soil shifting by wind. In the Connecticut Valley in the vicinity of Amherst sand storms are a common occurrence. The prevailing winds, coming from the northwest, have a rather uninterrupted sweep down the valley, and at times pick up and transport large quantities of soil consisting of sands, sandy loams, silt loams, clay loams and clays. It is the coarser members of the above soils that are most eroded because the heavier soils are usually covered with vegetation.

This shifting of the soil by wind action has

no doubt had an important part in shaping the topography of the region, which may be described as the level to rolling bottom of an ancient lake or arm of the sea dotted with sandy knolls or modified sand dunes. The shifting also presents to the farmers of the section some problems of soil management.

Probably the most striking instance in recent years of wind erosion of soils in this vicinity occurred on the days of April 27 to 30, 1922. Observations by the writer showed a drift as deep as three inches, the deepest observed being on the south sides of tobacco barns. Onion seeds were blown out of the soil necessitating in some cases reseeding, and no doubt many tons of fertilizer were carried from recently fertilized onion fields on which a first application of one ton of high grade fertilizer is the common practice. It was observed that any sort of a ground covering, even loose tobacco stalks, was rather effective in checking erosion, but a growing cover crop as commonly used in tobacco, but not onion, fields was most effective.

The winds most disastrous from the standpoint of soil erosion are those of two or more days' duration, the first day usually being required to dry the soil. Although sandstorms may occur frequently during the year, the most damage is done in the spring when the land is being or has been recently prepared for crops.

A. B. BEAUMONT

AMHERST, MASS.

SCIENTIFIC BOOKS

Development and Activities of the Roots of Crop Plants: A Study in Crop Ecology. By JOHN E. WEAVER, FRANK C. JEAN and JOHN W. CRIST. 17 x 25 cm., VI + 117 pages, 42 figures, 14 plates. Carnegie Inst. Washington, Publ. no. 316. May 11, 1922.

STUDENTS of plants, especially in physiology, ecology and agriculture, will be interested in Weaver, Jean and Crist's book on the roots of crop plants, in which is brought forth a mass of detailed information in a field that has been largely neglected until recently. The studies now reported are a continuation of those presented in Weaver's "Root Development in the Grassland Formation" (1920). Much of the present work follows the methods of his earlier investigations on the form and distribution of the root systems of uncultivated plants. The descriptive data are obtained by what must seem to most botanists very tedious and laborious excavations; each root is traced to its end and the size, form, etc., of the whole root system of each plant is shown diagrammatically on a chart. The published charts frequently show the size of the top, as well as the depth and spread of the root system and the number of roots. Root systems of plants growing under field conditions are described, in several stages of their development, for Lincoln and Peru, Nebraska, for Phillipsburg, Kansas, and for Burlington, Colorado, these stations having mean annual precipitations of about 33, 28, 23 and 17 inches, respectively. The plants dealt with are: oats, wheat, barley, maize, potato, alfalfa and sweet clover, for the seasons of 1919, 1920 and 1921. Some excellent experimental studies bearing on the soil-depths from which water and nitrate were removed during several developmental stages of the plants are considered in the final chapter of the book.

It is pointed out that the root systems of crop plants show modes of growth similar to those of native plants growing in the same region, both being apparently influenced by the environmental moisture conditions. With higher evaporation intensities and drier surface soils the root systems tend to be developed less extensively in the superficial soil layers and they extend farther into the deeper layers. There are some differences between the different forms of plants, but all the forms studied usually have, at the approach of maturity, a set of roots that ramify laterally in the upper 30 or 40 cm. of soil, and a set that reach downward, with more or less profuse branching, to depths of from 1 to nearly 3 m. The two portions of the root system may be relatively distinct or they may be nearly continuous. The deepest soil layers reached are of course not generally well occupied by branches.

The authors emphasize the fact that the roots of crop plants usually penetrate and

ramify far beyond the depth of tillage (12 to 20 cm.) and their studies lead to the conviction that much of the soil water and solutes entering the plant during its later growth stages must come from the greater depths. This appears to be at variance with statements in the prevailing text-books, as the authors remark, but of course the discussion of root activities is still necessarily very superficial in such treatises. It seems probable that, with increasing age of the plant, the region of greatest absorption is gradually transferred to the deeper soil layers. In almost every case of actual excavation, the total root development below the region of tillage was found to be as great as, and usually much greater than, that within the tilled region. To gain some quantitative information regarding absorption from the different soil layers, some ingenious experiments were carried out. The methods devised for this experimental study of absorption, together with the results secured, constitute the most valuable part of this book, and they should furnish an added impetus toward a physiological phase of root ecology, which is much needed and which seems about to be developed from several points of view.

Vertical sheet metal cylinders were employed as soil containers, large enough to allow complete development of the plants. The moist soil was placed in these, consecutive horizontal layers 15 or 30 cm. thick, separated by horizontal wax partitions that prevented movement of soil solution between adjacent layers but did not hinder root penetration. Sodium nitrate was added to some of the layers. Several kinds of controls were also employed. Rain was practically excluded. Oats, barley, potato, maize and two native grasses were studied, at various stages of their development, determinations being made of the loss of water and of nitrate from the several soil layers.

The amounts of water removed from the different soil layers were closely related to the frequency of roots, and absorption occurred from all layers occupied by the root systems. Maize absorbed large quantities from the third and fourth 30-cm. soil layer (counting from the top of the cylinder), and smaller quantities from the fifth. Potato absorbed to a depth of 75 cm., approximately the lower limit of the root system. Similarly, nitrate was markedly absorbed from the deeper occupied layers; maize removed 203, 140 and 118 parts per million from the third, fourth and fifth 30-cm. layer, respectively.

While the quantitative data are not expressed in terms such as would render them most valuable from all points of view (the authors use parts per million for nitrate measurements and percentage data for water measurements, both apparently based on the dry weight of the soil), yet they furnish convincing evidence that roots absorb water and nitrate at whatever depths the roots occur in the soil. This is quite in accord with what should be expected from our knowledge of the molecular physics of root absorption.

When a root system advanced into a soil layer to which nitrate had been added it developed more profusely than would have been the case without the extra nitrate, and this stimulation of branch development in the fertilized soil was accompanied by a corresponding retardation in the farther advance into the next layer below. From this observation it is suggested that, in field practice, the presence of added fertilizer salts in the superficial soil layers may hinder the development of roots into the deeper-lying soil, with possible resulting crop failure in case of a subsequent serious lack of water in the surface layers.

As a minor detail, it is regrettable that the metric system of measurements of distance seems not yet to have been appreciated by the authors, though weights are expressed in grams instead of ounces.

From my own point of view, the authors' presentation might have been improved considerably by a more thorough digestion of the results, with less space devoted to unessential details and more given to the fundamental considerations. There is evident a noticeable tendency toward "publishing the note-book." The general headings of the tables, and the column headings, might have been made much clearer. A well-made summary of the descriptive portion of the book would have rendered it much more valuable and far-reach-

ing. And the experimental results apparently contained considerable evidence that was not deduced from them, concerning some of the most fundamental questions of physiology. For example, it is not very useful to know rates of water or nitrate absorption from a soil as the authors express these, but it would be very enlightening to have these data expressed on the basis of the soil volume, or simply as absolute weights. What I have in mind, in this instance, is the question whether the solvent water of the soil solution carries the solute nitrate into the roots at its own rate of capillary or imbibitional flow, or whether the nitrate enters more or less rapidly than its solvent. A little more logical analysis and more attention to the deeper and somewhat hidden meanings implied in the experimental results might have strengthened the presentation very much. These suggestions are not made here, however, as serious adverse criticisms of the book I am reviewing. They are introduced, rather, with the idea that they may be a bit helpful in preparing the way for studies that will carry our knowledge of root ecology far beyond the present conceptions of any of us. The experimental methods employed by the authors involve essentials that are very promising indeed, and the results here published form an excellent beginning toward the illumination of one of the darkest corners of physiological ecology.

BURTON E. LIVINGSTON

SPECIAL ARTICLES

SOME ALGAL STATISTICS GLEANED FROM THE GIZZARD SHAD

IN a recent paper[1] the writer called attention to the desirability of using the gizzard shad, *Dorosoma cepedianum* Le Sueur, as collectors of the plankton algæ. These "living tow nets" do not get caught on snags and roots, the string does not break, and the algal collection is very representative of the body of water from which the fish were taken. It is necessary only to catch the young fish and examine their stomachic and intestinal content to secure a proportionate concentrated sample of the plankton. In aquatic areas where the gizzard shad are common these fish are well worth considering as aids in the collection of the plankton algæ.

Through the courtesy of its director, Dr. Stephen A. Forbes, the laboratory of the Illinois State Natural History Survey sent me some months ago several specimens of gizzard shad, collected in certain streams and ponds of Illinois during the late spring and summer of 1899 and 1900. Rather extensive collections of gizzard shad from Ohio, made during the summers of 1920 and 1921, gave some interesting statistics regarding the distribution and abundance of the non-filamentous algæ in various localities of the state. A comparison of the results of an examination of the stomachic and intestinal content of the fishes from Ohio and Illinois reveals similarities and differences in the algal flora of ponds and streams of the two states and in addition warrants some conclusions concerning the algal food of the gizzard shad in general.

1. The total number of species and varieties in an identifiable condition in the gizzard shad from the two states is a hundred and fifty. Very nearly identical forms indicate the phytoplankton similarity of the habitats from which the fish were taken.

2. The amount of mud present in the digestive tract is in some cases considerably more abundant in the Illinois fishes. It is not, however, in either case a matter of selection on the part of the fish but rather a direct function of the number of suspended mud particles present in the water, *i. e.*, it depends upon what enters with the water as the fish swims along with its mouth open.

3. Diatoms are relatively much more abundant in the Illinois fishes than in those taken in Ohio. When a microscopic mount is made of the intestinal content of some of the Illinois specimens, little else except diatoms can be seen. In this connection one might almost improve upon the epitome of Dr. Mann:[2] "No diatoms, no hake," for in that case it was necessary to have herring and copepods as

[1] *The Ohio Journal of Science*, 21, No. 4, p. 113, 1921.

[2] *Ecology*, 2, No. 2, p. 79, 1921.

intermediaries. Here, however, is a chain of two links, obviating the necessity of the "middle man," and five words tell a complete story: "No diatoms, no gizzard shad." In some fishes from Ohio another story is told by changing diatoms to *Pediastrum;* still another, if one puts in *Scenedesmus;* for most of the young fishes examined the complete story reads: "No phytoplankton, no gizzard shad."

4. Flagellate forms, species of *Euglena* and *Phacus* in particular, are less common in the Ohio fishes.

5. The relative abundance of the different forms of the phytoplankton of the bodies of water is revealed by the algal content of the gizzard shad found there.

6. In general, algal species belonging to the order *Protococcales* form more commonly a larger portion of the food of the gizzard shad than do either flagellates or diatoms. Sometimes, however, the condition is reversed; but this is apparently purely a matter of the plankton content of the water.

7. The fewness of the zooplankton forms is somewhat less marked in the specimens from Illinois than in those from Ohio. This may again be due to the predominance of the phytoplankton over the zooplankton in the localities where the fish were obtained.

8. The paucity of stream phytoplankton in comparison with that of ponds and lakes is shown by the relative algal content of the digestive tract of the gizzard shad taken from running and quiet waters. The excessive diatom content of stream water at certain periods—producing the so-called "pulses" of Kofoid[3]—when there is a marked rise in temperature is only temporary and may be explained, as Professor Transeau suggests, by the rapid dissolving of the mucus and a consequent breaking up of the chains and colonies of diatoms. This usually takes place in the small tributaries where the individual diatoms are thus freed from their places of attachment; and the main stream is merely the recipient of the contribution, not the source of the sudden "pulse."

9. There is a continuation of the above story in which the gizzard shad plays an important rôle: it feeds the game fishes, and the game fishes feed man. Thus, the gizzard shad is making useful for man the energy stored in plant forms which occupy no land areas, which do not interfere with the ordinary disposition or utilization of bodies of water (except the occasional contamination of water for drinking purposes by some algæ), which involve no labor of cultivation on the part of man, and which are of no value for direct human consumption.

10. The world's population in the last hundred years has increased about 150 per cent. Along with this increase has had to come a corresponding increase in the world's food supply. One of the ways in which this necessity has been met is the securing of new acres of soil in which to grow crops. It is easily seen, however, that there is a limit to new acreage. In the future, therefore, we may have to turn more of our attention to the cultivation of the waters for food supplies. We may have to develop an industry of aquiculture as we have developed an industry of agriculture. The time is rapidly approaching when fish will be more highly prized as food and more extensively used than now. As that time comes, the cultivation of algæ will be a first step toward greater fish production. A second step may be the introduction of fish like the gizzard shad into fish ponds and lakes to make more readily available the phytoplankton for fish food.

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[3] *Bulletin of the Illinois State Laboratory of Natural History,* 6, pp. 226, 569, 571, 1903.

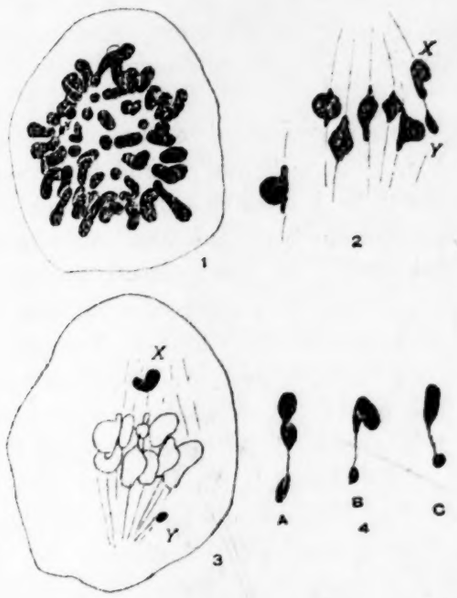
THE SEX CHROMOSOMES OF THE MONKEY[1]

PREVIOUS studies on the spermatogenesis of the opossum ('22) and on man (in press) have

[1] Contribution No. 159, Department of Zoology, University of Texas. The present work has been aided by a grant from the National Research Council—Committee for Research on Sex Problems. In view of the crowded condition of our journals which greatly delays publication, the author is presenting in this brief way the essential facts of general interest to biologists. The completed study will give the detailed evidence. Painter, T. S.: 1922, "The Spermatogenesis of the Opossum," *Journ. Exp. Zool., Vol.* 35.

shown that both of these mammals possess the X-Y type of sex chromosome. The spermatogenesis of the "ring-tail" monkey (exact species not yet determined) shows essentially the same conditions as were found in the opossum and in man.

In dividing spermatogonia (fig. 1) one counts 54 chromosomes. It is to be noted that the smallest element has no mate of like size and shape. It is the "male determining," or "Y" chromosome.



During the first maturation division one finds among the tetrads an element the two components of which are very unequal in size (fig. 2). This is the X-Y sex chromosome complex. The X and the Y components go undivided to opposite poles of the cell, so that the secondary spermatocytes have either an X or a Y chromosome. In the second maturation division the sex chromosome (either X or Y) divides equationally. 27 chromosomes have been counted in the late telophase of the second maturation division. (In figs. 2 and 3 only part of the tetrads are shown).

In figure 4 the sex chromosomes—as seen in the first maturation division—are given for A opossum, B monkey, C man. It is interesting to note that recent work on the genetics of man (Schoenfield—See Castle, SCIENCE, Vol. 55, p. 703) confirms the results of my cytological studies.

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A SIMPLE GAS GENERATOR FOR LABORATORY USE

IT is frequently necessary to prepare small quantities of carbon dioxide, hydrogen, hydrogen sulfide, chlorine, hydrochloric acid gas, oxygen, etc., in the general laboratory work and in many laboratories it is not practicable nor desirable to maintain a lot of elaborate equipment for the generation of these various gases, especially for the small quantities intermittently needed.

To prepare a special flask each time occasion arises to generate a gas is at least bothersome and time consuming and involves a waste of reagents. On the other hand, a simple piece of apparatus, taking no more room on the shelf than a reagent bottle, adaptable to the preparation of any of several gases at a moment's notice without waste of reagent, commends itself.

The apparatus here presented developed from such a need and can be easily prepared out of ordinary laboratory equipment; a large wide-mouthed bottle, two test tubes, two cocks, rubber stoppers and glass tubing are all that is required.

An examination of the diagram will show the simplicity and convenience of construction and operation.

CONSTRUCTION

Into the wide mouthed bottle *A* is fitted a large rubber stopper *D-D* containing one small hole for the tube *H* terminating in stopcock *N*, and a large hole for the large test tube B. At

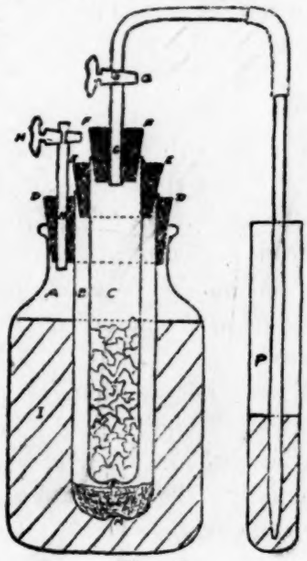

FIG. 1

the bottom of the large test tube is a hole *M* and over it is snugly fitted a layer of glass wool *L*. Into *B* the stopper *E-E* is placed, through which passes a smaller test tube *C*. This tube also has a small hole at the bottom *K*, and is fitted at the top with a stopper *F-F* through which passes a delivery tube fitted with stopcock *O*.

The large test tube *B* in stopper *D-D* should fit especially tight as it is not to be removed from the stopper. *E-E* should fit more loosely as it may be removed at will.

The bottle *A* is the reservoir for the acid *I*.

The tube *B* is a chamber for holding tube *C*.

C contains the zinc, iron sulfide, marble, peroxide, bleaching lime or fused ammonium chloride, etc. (which should, of course, be in lumps) with which the acid acts. A rack of tubes filled with different reagents and fitted with stoppers the same size as *E-E* afford a ready source for each gas, or tube *C* may be dumped and filled with a different reagent as desired.

Pinch cocks may be used instead of glass, or nearly any preferable type might be substituted.

OPERATION

Tube *C*, containing marble, zinc or whatever substance is required, *J*, and fitted with stoppers *E-E* and *F-F* and tube *G*, cock *O* of which is closed, is introduced into the chamber *B*. The air or gas in *C* prevents the acid from entering.

To operate, open *N* and *O*. Close *N* after acid has run into *C* through *M* and *K* so that the acid will not be forced out of *C*. Pass the delivery tube into the test tube *P* or collect in any other fashion.

To stop the generation, see that *N* is open. Close *O*. The gas will force the acid out of *C*, and out of *B*. The apparatus may then be set away for another time, or if preferred *C* may be removed in a comparatively dry condition both inside and outside after closing *N* so that the chamber *B* will remain empty while *C* is being removed.

The acid need not be changed except when any impurities it contains might interfere with the test to be run, or when it has eventually become exhausted. To supply new acid simply remove the stopper *D-D* which takes with it all the fixtures, empty the jar *A* and refill. Replace the stopper, and all is ready for use.

ARTHUR P. HARRISON
BUREAU OF PLANT INDUSTRY,
U. S. DEPARTMENT OF AGRICULTURE

THE OHIO ACADEMY OF SCIENCE

THE thirty-second annual meeting of the Ohio Academy of Science was held at Ohio State University, Columbus, April 14 and 15, 1922, under the presidency of Professor Raymond C. Osburn, of Ohio State University. Eighty-seven members were registered as in attendance; forty-six new members were elected.

The usual geological excursion was postponed until June 3 and 4, and took the form of a joint field meeting, on invitation of the geologists of the Michigan Academy of Science, for the study of the glacial geology and Silurian rocks of southeastern Michigan and adjoining portions of Ontario. The party was under the leadership of Mr. Frank Leverett, of the University of Michigan, and Professor W. H. Sherzer, of the Michigan State Normal College. Professor J. E. Carman, of the Ohio State University, collaborated in directing the investigations at certain localities.

The Committee on State Parks and Conservation reported progress in the listing of areas suitable for preservation. Director Taber, of the State Department of Agriculture, addressed the academy on the game preserves owned or leased by the state. The academy expressed its formal approval of the establishment of a state commission, including scientific representation, to advise in the acquisition of state parks and preserves and in their regulation to secure the maximum recreational, scenic and scientific returns.

The trustees reported the twenty-fifth annual gift of two hundred and fifty dollars from Mr. Emerson McMillin, of New York City, in furtherance of the research work of the academy. A resolution of thanks and the birthday greetings of the academy were sent to Mr. McMillin by night letter, to reach him on April 16, his seventy-eighth birthday. (The death of Mr. McMillin on May 31 has already been reported in SCIENCE. He was a member

of the academy since 1892, although his residence in New York had made attendance at the meetings impossible for many years).

Professor George D. Hubbard presented an appreciative memoir of G. Frederick Wright, who died on April 20, 1921. Professor Wright had been a member of the academy since 1892, and was one of the first group of fellows elected in 1920. He served as president in 1899. The memoir will appear in the Annual Report.

The following members were elected to fellowship in the academy: Annette F. Braun, Edward E. Clayton, William C. Devereaux, Henry Herbert Goddard, Clarence H. Kennedy, Kirtley F. Mather, Susan Percival Nichols, Bradley M. Patten, Jasper D. Sayre, Alpheus Wilson Smith, Frank R. Van Horn.

Officers were elected as follows: *President,* A. P. Weiss, Ohio State University; *Vice-presidents: Zoology,* Charles G. Rogers, Oberlin College; *Botany,* E. Lucy Braun, University of Cincinnati; *Geology,* Kirtley F. Mather, Denison University; *Physics,* R. C. Gowdy, University of Cincinnati; *Medical Sciences,* C. F. Spohr, Ohio State University; *Psychology,* H. H. Goddard, Ohio Bureau of Juvenile Research; *Secretary,* Edward L. Rice, Ohio Wesleyan University; *Treasurer,* A. E. Waller, Ohio State University.

The scientific program was as follows:

PRESIDENTIAL ADDRESS

Some common misconceptions of evolution: Professor Raymond C. Osburn, Ohio State University.

PUBLIC LECTURES

Disease and disease resistance in plants: Professor L. R. Jones, University of Wisconsin. (In joint session with the Ohio State University chapter of Sigma Xi).

Ether-drift experiments at Mount Wilson, California: Professor Dayton C. Miller, Case School of Applied Science.

PAPERS

Some proposed state parks for Ohio: J. ERNEST CARMAN.

Segregation and man: MAYNARD M. METCALF.

American biological stains for microscopical preparations: S. I. KORNHAUSER.

Further studies in the cytology of Anisolabis: S. I. KORNHAUSER.

Notes on tropical photography: WILLIAM RAY ALLEN.

Some unsolved problems in tidal zone ecology (By title): Z. P. METCALF.

Preliminary survey of certain aquatic habitats on the Bass Islands: F. H. KRECKER.

Some results from a pure-line isolation culture of Euglena gracilis Klebs: W. J. KOSTIR.

A source of material for study of parasites: MAYNARD M. METCALF.

Specific names for parasites: MAYNARD M. METCALF.

Studies of the biology of freshwater mussels: WILLIAM RAY ALLEN.

The relationship of the Syngnathidæ: JAMES E. KINDRED.

A quarter century of bird migration at Oberlin: LYNDS JONES.

A case of unhindered growth of the incisor teeth of the woodchuck: STEPHEN R. WILLIAMS.

A cicindelid from Lake Bennett, British Columbia: LYNDS JONES.

Factors influencing reproduction in the cucumber beetle (Diabrotica vittata Fabr): W. V. BALDUF.

Distribution and control of two important grape insects: D. M. DELONG.

A study of the distribution of the leafhoppers of Presque Isle, Pa.: D. M. DELONG.

Emergence of a subimago Mayfly: F. H. KRECKER.

Some factors which have limited and directed insect evolution: CLARENCE H. KENNEDY.

Insect parasites and predators in spider's nests: MARY AUTEN.

The inter-relation of the Hessian fly (Phytophaga destructor) and one of its parasites: T. H. PARKS.

Biological significance of the endocrines: A. B. PLOWMAN.

The effect of formaldehyde on the vitamins of milk: A. M. BLEILE and R. J. SEYMOUR.

Variation in the dandelion and some of its causes: P. B. SEARS.

A forest map of the Erie basin: P. B. SEARS.

The distribution of flowering plants on the smaller islands of Lake Erie: MALCOLM E. STICKNEY.

The sexual nature of vegetative or dichotomous twins of Arisæma: JOHN H. SCHAFFNER.

Influence of length of daylight on sex reversal in hemp: JOHN H. SCHAFFNER.

Some root and stem rots of clover in Ohio: SYLVESTER S. HUMPHREY.

Mosaic disease of tomato: RAYMOND A. DOBBINS.

Energy relations of plants: E. N. TRANSEAU.

Ecological distribution of grasses of North America: E. L. STOVER.

The algal food of fishes: L. H. TIFFANY.

Seedling blights of corn: WILMER G. STOVER.

The course of a plant disease: WILMER G. STOVER.

Extension work in plant pathology with special reference to the control of corn and potato diseases: E. E. CLAYTON.

Barberry eradication in Ohio: J. W. BARINGER.

A study of variation in Russula: H. C. BEARDSLEE.

Geologic control of river navigation in northeastern Bolivia: KIRTLEY F. MATHER.

The gorges of the Yangtze Kiang: GEORGE D. HUBBARD.

An inter-glacial gorge at Youngstown, Ohio: G. F. LAMB.

New points in the geology of Kelleys Island: MILDRED FISHER.

Some new data concerning the Bellefontaine outlier: CLARENCE F. MOSES.

The Pottsville formation of Ohio: HELEN MORNINGSTAR.

The Bainbridge caves: ROBERT F. WEBB.

The formation of box canyons in sandstone: J. E. HYDE.

Mineralization along the dikes of southern Vermont: HARRIET G. BRAY and ALDEN H. EMERY.

The Wheeler National Monument: ROBERT F. WEBB.

Colloids in geologic problems: GEORGE D. HUBBARD.

Dynamics of the lithosphere: O. C. JONES and GEORGE D. HUBBARD.

Drainage changes north of Lake Superior: ROBERT F. WEBB.

The Arctic as one of the centers of distribution of early Paleozoic faunas: AUGUST FOERSTE.

Meanders of Rio Securé and Rio Mamoré, Bolivia: KIRTLEY F. MATHER.

Iron molding sands of Ohio: J. A. BOWNOCKER.

Report on the Edward Orton Memorial Library: J. A. BOWNOCKER.

New fish remains from northwestern Ohio: J. ERNEST CARMAN.

Some fossils from the Sylvania sandstone: J. ERNEST CARMAN.

Type specimens of fossils in the geological museum at Ohio State University: HELEN MORNINGSTAR.

Stylolites: their nature and origin: PARIS B. STOCKDALE.

A mounted topographic map of Ohio: G. W. CONREY.

Notes on the Cincinnatian: W. H. SHIDDELER.

Forecasting the weather in the Ohio Valley: WILLIAM C. DEVEREAUX.

The electron theory of metals: ALPHEUS W. SMITH.

The effect of a unidirectional field upon alternating current permeability and energy loss in iron: ALVA W. SMITH.

Infra-red absorption bands as a means of determining molecular properties: ERWIN F. LOWRY.

Certain aspects of the problem of the static versus the dynamic atom: F. C. BLAKE.

The study of "illumination" in physics courses: F. C. CALDWELL.

Some interesting pictures in infra-red: YALE ROOTS.

Duriren—a product of Ohio industry: JAMES WITHROW.

A case of dual personality: HENRY H. GODDARD.

The field of psychology: B. H. BODE.

The theory of differential education as applied to the handicapped pupils in the elementary grades: J. E. W. WALLIN.

Qualitative clinical tests and psychological theory: H. B. ENGLISH.

Psychic complexes: A. W. TRETTIEN.

A comparison of initial and subsequent examinations of the same individual by the same psychological methods: MABEL R. FERNALD.

DEMONSTRATIONS

Common mole (Scalopus aquaticus machrinus Refinesque) "embalmed," and internal parasites of same: F. A. HANAWALT.

Tracheation of Lestes nymph: CLARENCE H. KENNEDY.

A plerocercoid (larval) tapeworm from the liver of the squirrel—externally segmented: STEPHEN R. WILLIAMS.

Head of woodchuck, showing unhindered growth of incisors: STEPHEN R. WILLIAMS.

Types of tomato mosaic: RAYMOND A. DOBBINS.

Seedling blights of corn: WILMER G. STOVER.

Stalactites in glacial sand and recent conglomerates from Canton, Ohio: G. F. LAMB.

Illumination charts: F. C. CALDWELL.

EDWARD L. RICE,
Secretary

DELAWARE, OHIO